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CREATING A 3D SEISMIC CUBE FROM 2D HIGH-RESOLUTION SEISMIC PROFILES. A CASE STUDY FROM THE MARINE MINE TAILINGS DEPOSIT IN PORTMÁN BAY, SPAIN

Soldevila E.*[1], Carbonell R.[2], Alcalde J.[2], Amblas D.[1] and Canals M.[1]

[1,] Department of Earth and Ocean Dynamics, Faculty of Earth Sciences, University of Barcelona, Barcelona, Spain.
emma.soldevila@ub.edu, damblas@ub.edu, miquelcanals@ub.edu
[2] Institue of Earth Science Jaume Almera (ICTJA), Spanish National Research Council (CSIC), Barcelona, Spain.
ramon.carbonell@csic.es, jalcalde@ictja.csic.es

Abstract: High-resolution (HR) 3D seismic acquisition is often not available. This work builds an optimized workflow to convert a dense 2D HR seismic grid into a 3D seismic volume. The task has been developed within a broader project, NUREIEVA, which aims at characterizing a metal-rich onshore and shallow marine mine tailings deposit in Portmán Bay, Murcia, Spain. Hence, in the framework of the NUREIEVA project a very dense set of 2D HR seismic lines was acquired using a hull-mounted Kongsberg TOPAS PS18 single-channel parametric source. The acquired seismic grid consisted of 1309 2D lines, with an approximate distance between lines of 10 m, covering an area of 7.45 km^2 and yielding a vertical resolution of 15 cm, very high if compared to conventional seismic reflection data.
In order to visualize the internal architecture of the mine tailings deposit in all directions, it is desirable to convert the dense 2D network of lines into a full 3D data volume. For this purpose, a new optimized 2D to 3D conversion processing flow has been designed. Given the specific characteristics of the input data, a number of challenges had to be addressed, namely: (i) a very high vertical resolution that differs by at least two orders of magnitude from the horizontal resolution; (ii) a large data volume (2 TB), which involves extensive computing time; (iii) the heterogeneity in the acquisition parameters. Because of this, the lines had to be processed previously to the 3D interpolation to homogenize the imaging characteristics and signal content. This new methodology can be now applied for obtaining a 3D volume to any case where a single channel dense 2D seismic grid is available. Furthermore, if duly adapted to each particular scenario, it represents a low cost alternative to conventional HR 3D seismic and could prevent further seismic shooting.

Key words: Seismic, Portman, 2D to 3D, TOPAS

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